MODEL 663

VOLT-OHM-MILLIAMMETER

INSTRUCTIONS
WITH PARTS LIST

WESTON®

SAFETY NOTICE

WESTON EXERTS EVERY EFFORT TO INSURE THAT THIS INSTRUMENT WILL PROVIDE SAFE, DEPENDABLE SERVICE. PERSONNEL USING THE INSTRUMENT ARE URGED TO ACQUAINT THEMSELVES WITH THE OPERATING INSTRUCTIONS BEFORE USING. OPERATING AND MAINTENANCE PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS WHEN MAKING MEASUREMENTS ON ELECTRICAL CIRCUITS.

AVOID CONTACT WITH ANY EXPOSED ENERGIZED ELECTRICAL CIRCUITS.

UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITIONS DUE TO CHARGES RETAINED BY CAPACITORS. TO AVOID HAZARDS, ALWAYS REMOVE POWER AND DISCHARGE AND GROUND CIRCUITS BY USE OF A GROUNDING STICK PRIOR TO TOUCHING THEM.

WHEN MAKING HIGH VOLTAGE MEASUREMENTS, DO NOT TOUCH THE TEST LEADS OR THE INSTRUMENT. BEFORE MAKING CONNECTIONS TO OR CHANGING THE POLARITY OF HIGH VOLTAGE CIRCUITS, ALWAYS FIRST DE–ENERGIZE THE CIRCUIT.

DANGEROUS ARCS OF EXPLOSIVE NATURE CAN OCCUR IF THE CIRCUIT IS SHORTED IN HIGH POWER CIRCUIT AREAS SUCH AS DISTRIBUTION TRANSFORMERS. ALWAYS SET THE RANGE SWITCH OF THE INSTRUMENT TO THE CORRECT POSITION BEFORE TAKING MEASUREMENTS. WHEN TAKING VOLTAGE MEASUREMENTS, NEVER SET RANGE SWITCH TO THE CURRENT OR LOW RESISTANCE POSITION.

INSTRUCTIONS
FOR
WESTON
MODEL 663
VOLT-OHM-MILLIAMMETER

(PATENTS PENDING)

Copyright 1975

WESTON INSTRUMENTS, INC.
614 FRELINGHUYSEN AVENUE, NEWARK, N. J. 07114

WESTON
Schlumberger

F-3742 R4
3/76

Printed in U.S.A.

TABLE OF CONTENTS

General Description

General 7
Accessories 7

Specifications

Overload Protection 7
Temperature Influence 8
Accuracy 9
Ranges 9
Frequency Influence 9

Operating Instructions

Reversing Switch 10
High Voltage Precautions 10
Relay Functional Test 10
DC Voltage Measurements to 500 V 10
DC Voltage Measurements above 500 V 10
AC Voltage Measurements to 500 V 11
AC Voltage Measurements above 500 V 11
DC Current Measurements to 500 mA 11
DC Current Measurements above 500 mA 12
Resistance Measurements 12
Output Meter Measurements 12
Decibel Measurements 13

TABLE OF CONTENTS (Continued)

Theory of Operation

DC Voltmeter 16
AC Voltmeter 17
Decibel Meter 18
Ohmmeter 18
DC Current Meter 19

Maintenance

Installation of Batteries 20
Fuse Replacement 20
Calibration 20
Procedure 20
Cleaning Procedure For Thermoplastic Meter Window 21
Circuit Board Removal 22
Component Replacement 22
Replacement Parts List 22

List of Illustrations

Figure 1 Model 663 Volt-Ohm Milliammeter 6
Figure 2 DC Volts Circuit 16
Figure 3 AC Volts Circuit 17
Figure 4 Ohmmeter Circuit 18
Figure 5 DC Current Circuit 19
Figure 6 Battery Installation Diagram 20
Figure 7 Calibration Adjustment Locations 21
Figure 8 Inner Board Assembly 27
Figure 9 Outer Board Assembly 28
Figure 10 Schematic Diagram 29

List of Tables

Table 1 Effect of Applying 220V AC or DC 8
Table 2 Frequency Response 9
Table 3 Data on dB Levels 13

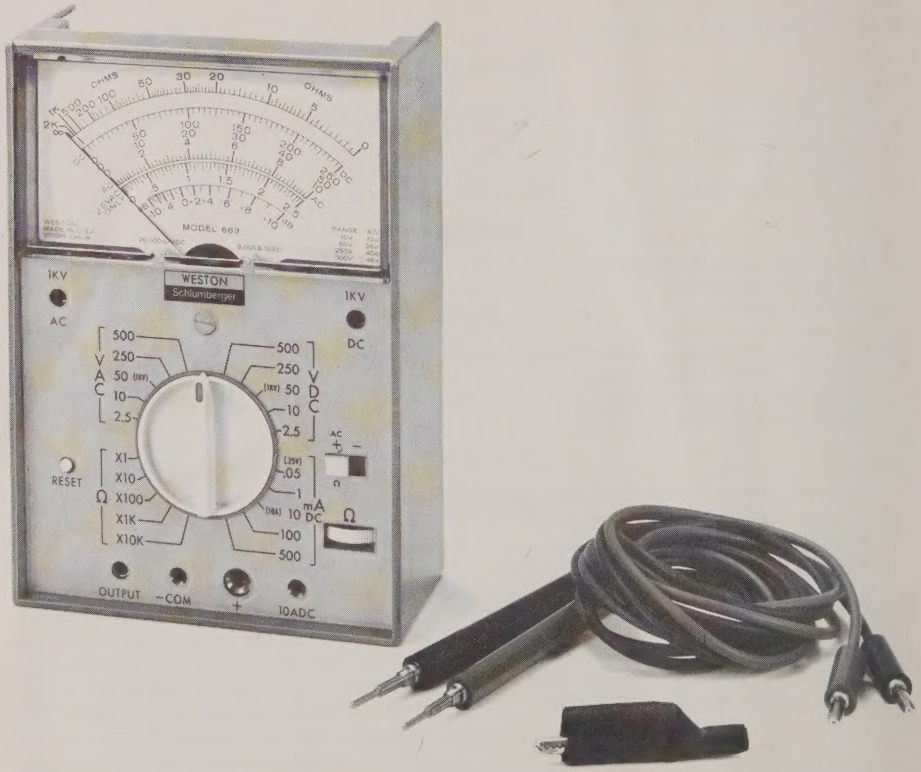

FIGURE 1. MODEL 663 VOLT-OHM-MILLIAMMETER

GENERAL DESCRIPTION

GENERAL: The Model 663 is a portable self-contained analog multimeter for bench, laboratory and field use. (See Figure 1) It is housed in a shock resistant polycarbonate thermoplastic case, and is designed for the greatest convenience, utility and ruggedness. The unit will withstand extremely rough handling with minimum degradation of accuracy and little damage. (See Warranty) Precision metal film, wire wound and carbon film resistors of ±0.5% tolerance are used to extend the range of a ruggedized taut band suspension, self-shielded core magnet microammeter. All components are mounted on two parallel circuit boards that plug together to form an assembly with no soldering required. Ranges have been chosen to give the best coverage for measurements in the electric and electronic fields. A large 4" mirror scale is provided for easy readability. Separate scales are provided for the 2.5 V AC range, the balance of the AC ranges, the DC ranges, DECIBELS, and OHMS. The ohms scale, with a 20 ohms center value, is figured from 0 to 2000 and is calibrated to provide accurate readings with good resolution.

A single knob and two banana jacks labeled + and - COM handle the majority of ranges. The 10 amp DC, Output and kilovolt ranges are on separate jacks. A 2 amp fuse that can be changed from the front without taking the instrument apart is provided in the + jack. The ability to withstand the application of 220 volts AC or DC overload to all but the 10 ampere DC range is a design feature.

ACCESSORIES:

Standard

1. Test leads (spare set) Weston Part/Drawing No. 270066. The leads are provided with test prods and an insulated screw on alligator clip.

Optional at extra cost

1. Protective Leather Carrying Case-Weston Part/Drawing No. 9970-271958.
2. Protective Leather Carrying Case with Adjustable Handle Stand - Weston Part/Drawing No. 9970-272160.
3. High Voltage Probe and Cable Assembly-Weston Part/Drawing No. 9970-271962 (less multiplier resistor).
   50 KVDC multiplier resistor extends 500 VDC range X 100 - Weston Part/Drawing No. 272890.
   25 KVDC multiplier resistor extends 250 VDC range X 100 - Weston Part/Drawing No. 271960.

SPECIFICATIONS

OVERLOAD PROTECTION: Overload Protection is provided for the voltage ranges and the highest ohms range by the overload relay. The current ranges and the RX1 through RX1K ohms ranges are protected by clamp diodes and the 2 ampere fuse. The trigger circuit for the relay is designed to operate between 4 and 6 times overload on the voltage ranges and at approximately 90 volts on the RX10K range. The 10 ampere range is the only range not protected for 220V overload.

When an overload is applied to the current circuits, the relay may trip in addition to having the fuse blow. To reset the circuit, the fuse must be replaced as well as resetting the relay. An overload on the RX1 through RX1K ranges will cause the fuse to blow, however, the relay will not trip. When the fuse is blown the + input jack is open and all ranges that require the use of this jack or OUTPUT jack will be inoperative.

TABLE 1. EFFECT OF APPLYING 220 VOLTS AC or DC

DC Voltage Ranges	Result
.25	Fuse blows & Relay opens
2.5	Relay opens
10	Relay opens
50	Relay opens
250	44 μA
500	22 μA
1000	11 μA

AC Voltage Range	Result
2.5	Relay opens
10	Relay opens
50	Relay opens
250	176 μA
500	88 μA
1000	44 μA

(Table 1 continued)

DC Milliampere Ranges	Result
.05	Fuse blows & Relay opens
1	Fuse blows & Relay opens
10	Fuse blows & Relay opens
100	Fuse blows & Relay opens
500	Fuse blows & Relay opens

10 Amperes DC Range	No protection

Resistance Ranges	Result
RX1	Fuse blows
RX10	Fuse blows
RX100	Fuse blows
RX1K	Fuse blows
RX10K	Relay opens

TEMPERATURE INFLUENCE: The metering circuit (0.25 VDC range) is temperature compensated for the copper of the moving element with a thermistor-shunt combination resulting in a temperature coefficient for that range within 0.1% per °C over a ±10°C change from 25°C ambient. Low temperature error is maintained for other ranges by the use of multipliers and shunts constructed from 150 PPM per °C metal film, and 90 PPM and 50 PPM wire wound resistors. High voltage multipliers are constructed from 500 PPM per °C carbon film resistors. This results in a temperature coefficient for all DC ranges of 1% and for all AC ranges of 1.5% or better for a ±10°C change from room temperature.

ACCURACY: The following accuracies are based on meter in horizontal position:

DC Volts: 0.25 - 500 ±1%
1000 ±1.5%

AC Volts: 2.5 - 500 ±2%
(60Hz Sine wave) 1000 ±2.5%

DC Current: 0.05mA - 10 amps ±1%

Ohms: X1 Range ± 1.5 degrees at center scale
X10 thru X10K Ranges ±1 degree at center scale

FREQUENCY INFLUENCE: The error due to the influence of frequency on the AC ranges is given in Table 2 based on having the input leads twisted together and using the + and - COM input jacks.

TABLE 2. FREQUENCY RESPONSE

AC VOLT Ranges	Frequency Response
2.5	3% from 25Hz to 100KHz
10	3% from 25Hz to 100KHz
50	5% from 25Hz to 100KHz
	3% from 25Hz to 50KHz
250	5% from 25Hz to 10KHz
	3% from 25Hz to 5KHz

RANGES:

DC VOLTS	AC VOLTS	OUTPUT dB	DC CURRENT	OHMS	
				FULL SCALE	CENTER SCALE
0.25	2.5	-10 to +10	0.05mA	2,000	20
2.5	10	+2 to +22	1mA	20,000	200
10	50	+16 to +36	10mA	200,000	2,000
50	250	+30 to +50	100mA	2 Meg	20,000
250	500	+36 to +56	500mA	20 Meg	200,000
500	1000		10 Amps		
1000					

OPERATING INSTRUCTIONS

REVERSING SWITCH: A polarity reversing mode switch is located on the right of the front panel above the ohms adjust wheel. Two positions are provided labeled AC + Ω for normal operation and — for reverse DC operation. The AC + Ω position is used when measuring AC voltage, OHMS or DC with -COM input jack negative. The — position is used when the polarity of applied DC is reversed or when it is more convenient to reverse the meter polarity than the test leads.

HIGH VOLTAGE PRECAUTIONS: When making high voltage measurements, do not touch the leads or the Model 663. Before making connections to or changing the polarity of high voltage circuits, always first de-energize the circuit. To minimize the hazard of high voltage, it is good practice to be certain to insert the banana plug fully into the jack so that no bare metal is exposed.

RELAY FUNCTIONAL TEST: To test relay circuitry and 15 volt battery power supply after long periods of storage, proceed as follows:

1. Rotate RANGE switch to 500 volt DC position.
2. Remove rear cover to expose the battery compartment.
3. Plug a test lead into -COM jack and momentarily contact -15V battery clip.
4. Relay should operate. This test may be repeated as often as desired without causing damage to the instrument.

DC VOLTAGE MEASUREMENTS TO 500 V:

1. Set MODE switch to AC + Ω.
2. Rotate RANGE switch to desired DC voltage range.
3. Plug BLACK test lead into -COM jack and connect to LOW POTENTIAL circuit point.
4. With circuit to be tested de-energized, plug RED test lead into + jack and connect to HIGH POTENTIAL circuit point.

CAUTION: IF VOLTAGE TO BE MEASURED IS UNKNOWN, START AT THE 500 V RANGE AND WORK DOWN.

5. Energize circuit.
6. Without touching meter or leads, read DC VOLTAGE on DC arc.

Range Switch Setting	Figures Used
(0.25 V)*	0 to 250 ÷1000
2.5 V	0 to 250 ÷100
10 V	0 to 10
50 V	0 to 50
250 V	0 to 250
500 V	0 to 50 x 10

DC VOLTAGE MEASUREMENTS ABOVE 500V:

1. Rotate RANGE switch to (1KV) 50 or 500 DC position.
2. Plug BLACK test lead into -COM jack and connect to GROUND or LOW POTENTIAL circuit point.
3. Plug RED test lead into the 1KVDC jack corresponding to RANGE selected in step 1.

* The 0.25 V DC range and the 0.05 mA DC range use the same switch position.

4. With circuit to be tested de-energized, connect RED lead to TEST POINT.
5. Energize circuit.
6. Without touching meter or leads, read DC VOLTAGE on DC arc.

Range	Switch Setting	Figures Used
1000 VDC	(1KV) 50 V DC	0 to 10 x 100

AC VOLTAGE MEASUREMENTS TO 500 V:

1. Set MODE switch to AC + Ω.
2. Rotate RANGE switch to desired AC VOLTAGE range.
3. With circuit to be tested de-energized, plug BLACK test lead into -COM jack and connect to LOW POTENTIAL circuit point.
4. Plug RED test lead into + jack.

CAUTION: IF VOLTAGE TO BE MEASURED IS UNKNOWN, START AT THE 500 V RANGE AND WORK DOWN.

5. Energize circuit.
6. Without touching meter or leads, read AC VOLTAGE less than 2.5 VAC directly on LOWER AC arc.

Range Switch Setting	Figures Used	Scale Arc Used
2.5V	0 - 2.5	Lower AC
10 V	0 - 10	Upper AC
50 V	0 - 50	Upper AC
250 V	0 - 250	Upper AC
500 V	0 - 50 X 10	Upper AC

AC VOLTAGE MEASUREMENTS ABOVE 500V:

1. Set MODE switch to AC +Ω.
2. Rotate RANGE switch to 50 (1KV) or 500 AC position.
3. Plug BLACK test lead into the -COM jack and connect to GROUND or LOW POTENTIAL circuit point.
4. Plug RED test lead into the 1KVAC jack corresponding to RANGE selected in step 2.
5. With circuit to be tested de-energized, connect RED lead to TEST POINT.
6. Energize circuit.
7. Without touching meter, read HIGH VOLTAGE AC on the UPPER AC arc.

Range	Switch Setting	Figures Used
1000 V AC	50 (1KV) AC	0 to 10 x 100

DC CURRENT MEASUREMENTS TO 500 mA:

1. Rotate RANGE switch to desired CURRENT range. If range is unknown start with 500 mA and work DOWN.
2. Plug BLACK test lead into -COM jack.
3. Plug RED test lead into + jack.
4. Connect LEADS in series with LOAD.
5. With the MODE switch set to AC + Ω, current into RED lead and out of BLACK lead will produce an up scale reading when circuit is energized.
6. Read DC CURRENT on DC arc.

Range Switch Setting	Figures Used
0.05 mA*	0 - 50 ÷ 1000*
1 mA	0 - 10 ÷ 10
10 mA	0 - 10
100 mA	0 - 10 X 10
500 mA	0 - 50 X 10

DC CURRENT ABOVE 500mA:

1. Rotate RANGE switch to (10A) 10 position.
2. Plug BLACK test lead into the -COM jack.
3. Plug RED test lead into the 10 A DC jack.
4. Connect LEADS in series with LOAD.
5. With the MODE switch set to AC + Ω, current into RED lead and out of BLACK lead will produce an up scale reading when circuit is energized.
6. Read DC CURRENT on DC arc.

Range Switch Setting	Figures Used
(10A) 10 mA DC	0 - 10

RESISTANCE MEASUREMENTS:

CAUTION: MAKE SURE ALL POWER IS OFF BEFORE CONNECTING THE MODEL 663 TO THE TEST CIRCUIT.

1. Set MODE switch to AC + Ω position.
2. Plug BLACK test lead into -COM jack.
3. Plug RED test lead into + jack.

* The 0.05 mA range may be read as 50 μA using the figures 0 - 50 without the conversion factor of 1000.

4. Rotate RANGE switch to desired ohmmeter range.
5. Short TEST LEADS together and set POINTER to FULL SCALE position (0 ohms) by adjusting the Ω thumbwheel.
6. Read RESISTANCE on the OHMS arc.

Range Switch Setting	Multiply Scale Readings By
Ω X 1	1
Ω X 10	10
Ω X 100	100
Ω X 1K	1000
Ω X 10K	10,000

NOTE:

1. Polarity of internal battery voltage is POSITIVE on + jack and NEGATIVE on -COM jack.
2. If the ohmmeter can not be adjusted to the 0 ohms scale position on the (Ω X 1) range, then replace the 1.5 V "D" Cell; on the (Ω X 10K) range, replace the 15 V battery.

OUTPUT METER MEASUREMENTS:

The output meter is used for making AC voltage measurements when DC voltage is present. When using the OUTPUT jack of the Model 663, the DC component is blocked by a 0.22μf 400 volt capacitor. The cutoff frequency of the output meter is altered from the data given in Table 2 as follows:

Range	Low Frequency Cutoff
2.5 V AC	1K Hz
10 V AC	300 Hz
50 V AC	50 Hz

To use the output meter of the Model 663, follow the instructions given under AC VOLTAGE MEASUREMENTS to 500 VAC except plug the RED lead into the OUTPUT jack.

DECIBEL MEASUREMENTS:

To measure decibels, follow the procedure under AC VOLTAGE MEASUREMENTS to 500 V AC. If DC blocking is desired, follow the procedure under Output Meter Measurements above. Read decibels on the arc marked -10 to +10 dB. Zero power level is based on 1 milliwatt in a 600 ohm line. This condition must be met for making absolute dB measurements.

Range VAC	dB Range	Add to Reading on -10 to +10 dB arc
2.5	-10 to +10	0
10	+ 2 to +22	+12
50	+16 to +36	+26
250	+30 to +50	+40
500	+36 to +56	+46

NOTE:

When reading -10 to +10 dB on the 2.5 volt AC range, the (0 dB) mark is high by approximately 1 dB due to the rectifier characteristic of that range. Use DATA on dB LEVELS, Table 3, to determine dB level corresponding to the voltage indicated if a more accurate reading is desired.

TABLE 3. DATA ON dB LEVELS

Power Level dB	Volts, based on 0 dB of		
	6MW in 500 Ohms	6MW in 600 Ohms	1 MW in 600 Ohms
-10	0.548	0.600	0.245
- 9	0.614	0.673	0.275
- 8	0.689	0.755	0.308
- 7	0.774	0.847	0.346
- 6	0.868	0.951	0.388

(Table 3 continued)

Power Level dB	Volts, based on 0 dB of		
	6MW in 500 Ohms	6MW in 600 Ohms	1MW in 600 Ohms
- 5	0.974	1.067	0.436
- 4	1.093	1.197	0.489
- 3	1.226	1.343	0.548
- 2	1.376	1.507	0.615
- 1	1.544	1.691	0.690
0	1.732	1.897	0.775
+ 1	1.943	2.129	0.869
+ 2	2.180	2.389	0.975
+ 3	2.447	2.680	1.094
+ 4	2.745	3.007	1.228
+ 5	3.080	3.374	1.377
+ 6	3.456	3.787	1.545
+ 7	3.878	4.248	1.734
+ 8	4.351	4.766	1.946
+ 9	4.882	5.347	2.183
+10	5.477	6.000	2.449
+11	6.145	6.732	2.748
+12	6.895	7.554	3.084
+13	7.737	8.475	3.460
+14	8.681	9.509	3.882
+15	9.740	10.67	4.356
+16	10.93	11.97	4.887
+17	12.26	13.43	5.484
+18	13.76	15.07	6.153
+19	15.44	16.91	6.904
+20	17.32	18.97	7.746
+21	19.43	21.29	8.691
+22	21.80	23.89	9.752

(Table 3 continued)

Power Level dB	Volts, based on 0 dB of		
	6MW in 500 Ohms	6MW in 600 Ohms	1MW in 600 Ohms
+23	24.47	26.80	10.94
+24	27.45	30.07	12.28
+25	30.80	33.74	13.77
+26	34.56	37.87	15.45
+27	38.78	42.48	17.34
+28	43.51	47.66	19.46
+29	48.82	53.48	21.83
+30	54.77	60.00	24.49
+31	61.45	67.32	27.48
+32	68.95	75.54	30.84
+33	77.37	84.75	34.60
+34	86.81	95.09	38.82
+35	97.40	106.70	43.56
+36	109.3	119.7	48.87
+37	122.6	134.3	54.84
+38	137.6	150.7	61.53
+39	154.4	169.1	69.04
+40	173.2	189.7	77.46
+41	194.3	212.9	86.91
+42	218.0	238.9	97.51
+43	244.7	268.0	109.4
+44	274.5	300.7	122.8
+45	308.0	337.4	137.7
+46	345.6	378.7	154.6
+47	387.8	424.8	173.4
+48	435.1	476.6	194.6
+49	488.2	534.7	218.3
+50	547.7	600.0	244.9

THEORY OF OPERATION

DC VOLTMETER: The basic circuit is constructed to be a 250 millivolt meter using a 50 microamp indicator resulting in a sensitivity of 20,000 ohms per volt and a resistance of 5000 ohms. The 250 millivolt circuit is temperature compensated for the copper resistance of the microammeter by the use of a thermistor RT1 and shunt R41 combination. As the range is changed, additional resistance is added in series with the 250 millivolt circuit to maintain 20,000 ohms per volt at the selected voltage steps. The simplified circuit is shown in figure 2.

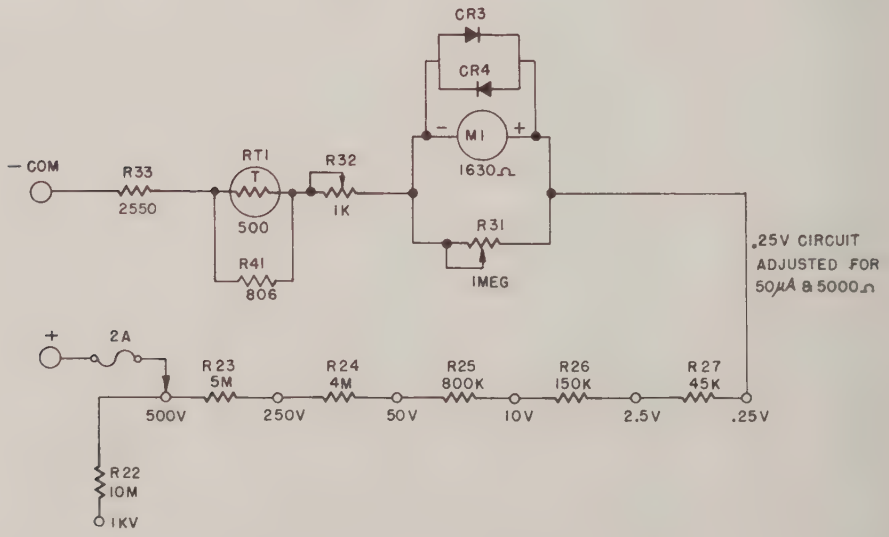

FIGURE 2. DC VOLTS CIRCUIT

AC VOLTMETER: AC voltage is converted to DC by a full wave half bridge germanium rectifier circuit and averaged by the microammeter. Scale calibration is RMS of a sine wave. The germanium rectifier used is selected for low reverse current and low forward resistance allowing the 2.5 VAC range to be more linear in its characteristic than if silicon rectifiers were used. The bridge circuit is adjusted for a sensitivity of 200 microamperes AC. As the range is changed, additional resistance is added in series with the AC input to the bridge rectifier circuit at a value corresponding to 5000 ohms per volt. The simplified circuit is shown in figure 3.

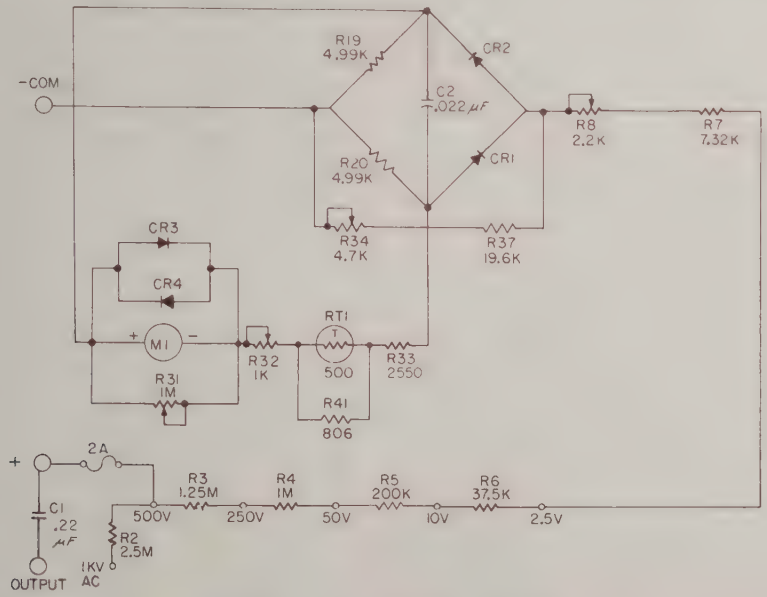

FIGURE 3. AC VOLTS CIRCUIT

DECIBEL METER: The dB meter uses the circuitry of the AC Voltmeter for its operation. Decibels are read on the dB scale which is based on a (O dB) power level of 0.001 watts in 600 ohms. Absolute readings on the dB scale are correct when the (O dB) power level is set to 0.001 watts and the dB measurement is made across 600 ohms. (.775 AC volts into 600 ohms)

OHMMETER: A conventional series ohmmeter circuit is used as illustrated in figure 4. The circuit is designed for a center scale value of 20 ohms on the (x 1) range. Ranges are changed by altering the internal resistance and sensitivity for the (x 1) through (x 1000) ranges. On the (x 10, 000) ranges, the internal resistance

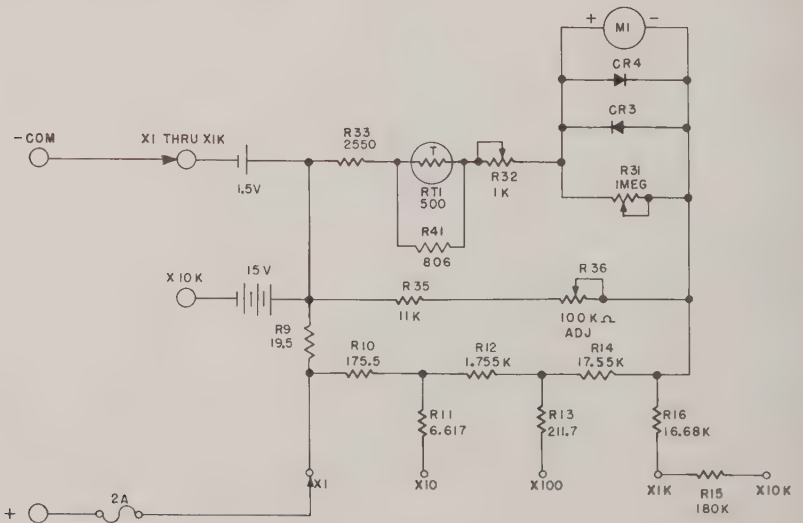

FIGURE 4. OHMMETER CIRCUIT

and supply voltage are changed maintaining the sensitivity of the (x 1000) range. The internal resistance for any range is equal to the center scale resistance value of that range; either 20, 200, 2000, 20, 000 or 200, 000 ohms. The internal power supplied to the (x 1) through (x 1000) ranges is 1.5 volts DC nominal and for the (x 10, 000) range is 15 volts DC nominal. The maximum short circuit current will occur on the (x 1) range and will have a value of approximately 80 milliamperes with a new battery. The maximum open circuit voltage will occur on the (x 10, 000) range and will have a value of approximately 16.5 volts with a new battery.

The sensitivity of the microammeter is adjusted for variations in battery voltage by the thumbwheel adjusting pot, R36.

DC CURRENT METER: An Ayrton type shunt network is used in the DC current meter as illustrated in figure 5. This type of shunt allows current to be reduced for measurement while maintaining a constant damping resistance across the microammeter. The metering portion of this circuit is adjusted to 250 millivolts at 50 microamps and is used for the 0.25 volt DC and 0.050 milliampere range. Current applied to any range will divide inversely proportional to the total resistance in each branch of the parallel circuit.

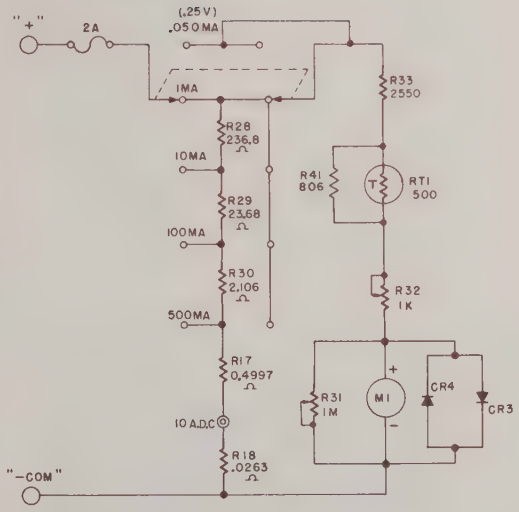

FIGURE 5. DC CURRENT CIRCUIT

MAINTENANCE

INSTALLATION OF BATTERIES:

1. Remove rear cover nut with a coin or thumbnail.
2. Use rear cover nut to pick up bottom of rear cover.
3. Slide rear cover off towards bottom of instrument.
4. Wrap 1.5 V "D" cell with cushion provided and insert into large cavity with polarity as shown in figure 6.
5. Insert 15 V battery in right compartment with polarity as shown in figure 6.
6. Be certain batteries are pressed firmly into place.
7. Replace rear cover and rear cover nut.

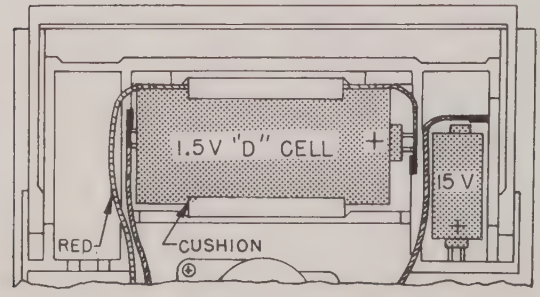

FIGURE 6
BATTERY INSTALLATION DIAGRAM

FUSE REPLACEMENT:

1. Remove rear cover nut. Do not remove rear cover.
2. Insert rear cover nut into + jack.
3. Use rear cover nut as tool to remove + jack fuse holder by turning counterclockwise.
4. Remove fuse from holder with a twist and pull.
5. Replace burned out fuse with a Littlefuse Part No. 361002, 2 amp 8AG instrument fuse or equivalent.
6. Replace fuse holder into + jack and tighten finger tight with rear cover nut tool.
7. Replace rear cover nut.

CALIBRATION: This instrument has been calibrated at the factory. However, if recalibration is required, it can be done without removing the instrument from the case. See figure 7 for adjustment locations. Minimum calibration equipment required is as follows:

DC Current source capable of 50 microamperes, ±0.25% at 250 millivolts

DC Voltage source capable of 250 millivolts, ±0.25%

AC Voltage source capable of 2.5 volts, ±0.4% and 50 volts, ±0.4% at 50 to 100 Hz sine wave output.

PROCEDURE:

1. Remove snap on front plastic range plate by hooking a non-metallic object such as your thumbnail under the plate at the Ω thumbwheel opening and pulling away from the instrument until the front plate snaps off.

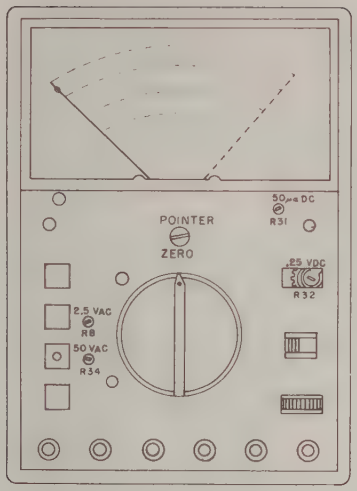

FIGURE 7. CALIBRATION ADJUSTMENT LOCATION

2. Place INSTRUMENT in a HORIZONTAL position.
3. Set POINTER on 0 with screw driver adjustment located about 5/8" below window ledge.
4. Set REVERSING switch to AC + Ω position.
5. Set RANGE switch to 0.05 mA (0.25 V) position. Momentarily drop range plate over switch to be certain switch position is correct.
6. Apply 50 μA DC to -COM and + jacks.
7. Set POINTER to FULL SCALE deflection by adjusting R31.
8. Apply 250 mV DC to -COM and + jacks.
9. Set POINTER to FULL SCALE deflection by adjusting R32.
10. Set RANGE switch to 50 (1KV) VAC position. Check switch position by overlaying range plate as in step 5.
11. Apply 50 VAC to -COM and + jacks.
12. Set POINTER to FULL SCALE deflection by adjusting R34.
13. Apply 2.5 VAC to -COM and + jacks.
14. Set RANGE switch COUNTERCLOCKWISE to 2.5 VAC position. Again check position with range plate.
15. Set POINTER to FULL SCALE deflection by adjusting R8.
16. Replace front plastic range plate by putting the side closest to the window under the ledge of the window, then press down firmly with both thumbs while encircling the lip around the range switch knob. The plate will snap down under this lip.
17. This completes calibration. All other calibration is fixed by component value and tolerance. If sufficient equipment is available, check full scale value for every other range.

CLEANING PROCEDURE FOR THERMOPLASTIC METER WINDOW:

Clean plastic meter window with absorbent cotton dipped in a solution made by dissolving

1/2 teaspoon of detergent, such as Vel or Dreft, in one gallon of water. Lightly wipe over window and allow solution to air dry. DO NOT WIPE DRY. DO NOT USE ANY CHEMICAL SOLVENTS TO CLEAN WINDOW OR CASE.

CIRCUIT BOARD REMOVAL:
The circuit boards are removed from the case without unsoldering any wires by the following procedure:

1. Remove rear cover screw and rear cover.
2. Remove batteries and slide battery clips out of the case.
3. Remove two 1/4" hex head screws with a 1/4" socket type wrench.
4. Remove SNAP ON range plate.
5. Remove -COM, + and 10 ADC jacks using the rear cover nut as a tool.
6. Remove circuit board assembly from the case.
7. Carefully unplug the circuit boards from one another.

To reassemble, reverse the above procedure. Be certain that the switch rotors and shaft are in alignment before inserting the boards into the case. To align switch rotors remove the shaft from the knob and use it as an alignment tool. Put the board assembly into the case without the shaft. Put the shaft in last and engage the knob.

COMPONENT REPLACEMENT: Fixed resistors with values up to 1.25 Megohms are either precision metal film or wire wound types. The higher values are carbon film resistors. If for any reason a component on a printed circuit board becomes damaged, it should be removed by cutting the leads close to the body of the component leaving the leads protruding above the board. The replacement component is then soldered directly to these leads, thereby preventing damage to the circuit board rails.

REPLACEMENT PARTS LIST
MODEL 663

Circuit Symbol	Description	Weston Part No.
BT1	BATTERY: 1.5 volts; size D	19637-001
BT2	BATTERY: 15 volts; Eveready No. 411	23912-001
C1	CAPACITOR, 0.22μF 400 WVDC	272429-001
C2, C3, C5, C6, C7, C8	CAPACITOR, 0.022μF 25 WVDC	272536-001

REPLACEMENT PARTS LIST MODEL 663 (Continued)

Circuit Symbol	Description	Weston Part No.
C4	CAPACITOR, ELECTROLYTIC: 80μF 25WVDC	272428-001
CR1, CR2	DIODE, GERMANIUM	39705-001
CR3, CR4, CR5, CR6, CR7, CR8, CR11	DIODE, SILICON	61025-001
CR9, CR10	DIODE, SILICON	272364-001
CR12, CR13	DIODE, SILICON	274207-001
E1	WHEEL, THUMB KNOB	270781-001
E2	KNOB, Range Switch	270770-901
E3	SHAFT, Range Switch	270771-001
E4	ROLLER, DETENT	267334-001
E5	SPRING, DETENT	267333-001
E6	HANDLE	271058-001
E7	DIAL, Range Plate	270772-902
E8	NUT, THUMB, Rear Cover	270786-024
E9	BUTTON, RELAY	271660-001
F1	FUSE, 2 ampere	60764-001
K1	RELAY	271654-901
M1	METER/CASE ASSEMBLY	271693-905
Q1	TRANSISTOR	268795-001
Q2	TRANSISTOR	263642-001
R2	RESISTOR, FIXED, CARBON FILM: 2.5 Megohms, ±1%, 1/2 watt	39679-001
R3	RESISTOR, FIXED, METAL FILM: 1.25 Megohms, ±0.5%, 1/2 watt	272460-001
R4	RESISTOR, FIXED, METAL FILM: 1.0 Megohm, ±0.5%, 1/4 watt	272475-001

Circuit Symbol	Description	Weston Part No.
R5	RESISTOR, FIXED, METAL FILM: 200K ohms, ±0.5%, 1/4 watt	272474-001
R6	RESISTOR, FIXED, METAL FILM: 37.5K ohms, ±0.5%, 1/4 watt	272473-001
R7	RESISTOR, FIXED, METAL FILM: 7.32K ohms, ±1%, 1/4 watt	272441-001
R8	RESISTOR, VARIABLE, CARBON COMPOSITION: 2.2K ohms, ±20%, 1/10 watt	272354-001
R9	RESISTOR, FIXED, METAL FILM: 19.5 ohms, ±0.5%, 3 watts	276205-001
R10	RESISTOR, FIXED, METAL FILM: 175.5 ohms, ±0.5%, 1/8 watt	272469-001
R11	RESISTOR, FIXED, WIRE WOUND: 6.617 ohms, ±0.5%, 3 watts	272461-001
R12	RESISTOR, FIXED, METAL FILM: 1755 ohms, ±0.5%, 1/8 watt	272468-001
R13	RESISTOR, FIXED, METAL FILM: 211.7 ohms, ±0.5%, 1/8 watt	272467-001
R14	RESISTOR, FIXED, METAL FILM: 17.55K ohms, ±0.5%, 1/8 watt	272466-001
R15	RESISTOR, FIXED, METAL FILM: 180K ohms, ±0.5%, 1/8 watt	272464-001
R16	RESISTOR, FIXED, METAL FILM: 16.68K ohms, ±0.5%, 1/8 watt	272465-001
R17	RESISTOR, FIXED, WIRE WOUND: 0.4997 ohms, ±0.5%, 3 watts	272463-001
R18	RESISTOR, FIXED, SHUNT: 0.0263 ohms, ±0.5%,	271053-902
R19, R20	RESISTOR, FIXED, METAL FILM: 4.99K ohms, ±1%, 1/4 watt	272442-001

Circuit Symbol	Description	Weston Part No.
R22	RESISTOR, FIXED, CARBON FILM: 10 Megohms, ±1%, 1/2 watt	272318-001
R23	RESISTOR, FIXED, CARBON FILM: 5 Megohms, ±0.5%, 1/2 watt	272458-001
R24	RESISTOR, FIXED, CARBON FILM: 4 Megohms, ±0.5%, 1/2 watt	272459-001
R25	RESISTOR, FIXED, METAL FILM: 800K ohms, ±0.5%, 1/4 watt	272476-001
R26	RESISTOR, FIXED, METAL FILM: 150K ohms, ±0.5%, 1/4 watt	272477-001
R27	RESISTOR, FIXED, METAL FILM: 45K ohms, ±0.5%, 1/4 watt	272478-001
R28	RESISTOR, FIXED, METAL FILM: 236.8 ohms, ±0.5%, 1/8 watt	272472-001
R29	RESISTOR, FIXED, METAL FILM: 23.68 ohms, ±0.5%, 1/8 watt	272471-001
R30	RESISTOR, FIXED, WIRE WOUND: 2.106 ohms, ±0.5%, 3 watts	272462-001
R31	RESISTOR, VARIABLE, CARBON COMPOSITION: 1 Megohms, ±20%, 1/10 watt	272381-001
R32	RESISTOR, VARIABLE, CARBON COMPOSITION: 1000 ohms, ±20%, 1/10 watt	272602-001
R33	RESISTOR, FIXED, METAL FILM: 2550 ohms, ±1%, 1/4 watt	278114-001
R34	RESISTOR, VARIABLE, CARBON COMPOSITION: 4.7K ohms, ±20%, 1/10 watt	272431-001
R35	RESISTOR, FIXED, METAL FILM: 11K ohms, ±1%, 1/4 watt	272443-001

Circuit Symbol	Description	Weston Part No.
R36	RESISTOR, VARIABLE, CARBON COMPOSITION: 100K ohms, ±20%, 1/2 watt	270780-903
R37	RESISTOR, FIXED, METAL FILM: 19.6K ohms, ±1%, 1/4 watt	272444-001
R38, R39	RESISTOR, FIXED, CARBON COMPOSITION: 100K ohms ±5%, 1/4 watt	266592-001
R40	RESISTOR, FIXED, CARBON COMPOSITION: 1.8K ohms ±5%, 1/4 watt	272427-001
R41	RESISTOR, FIXED, METAL FILM: 806 ohms ±1%, 1/8 watt	278105-001
RT1	THERMISTOR: 500 ohms ±10%	278104-001
S1-1	SWITCH: Range Deck	270779-905
S1-2	SWITCH: Function Deck	270779-904
S2	SWITCH: Reversing	271044-001
W1	LEAD, TEST SET	270066-001

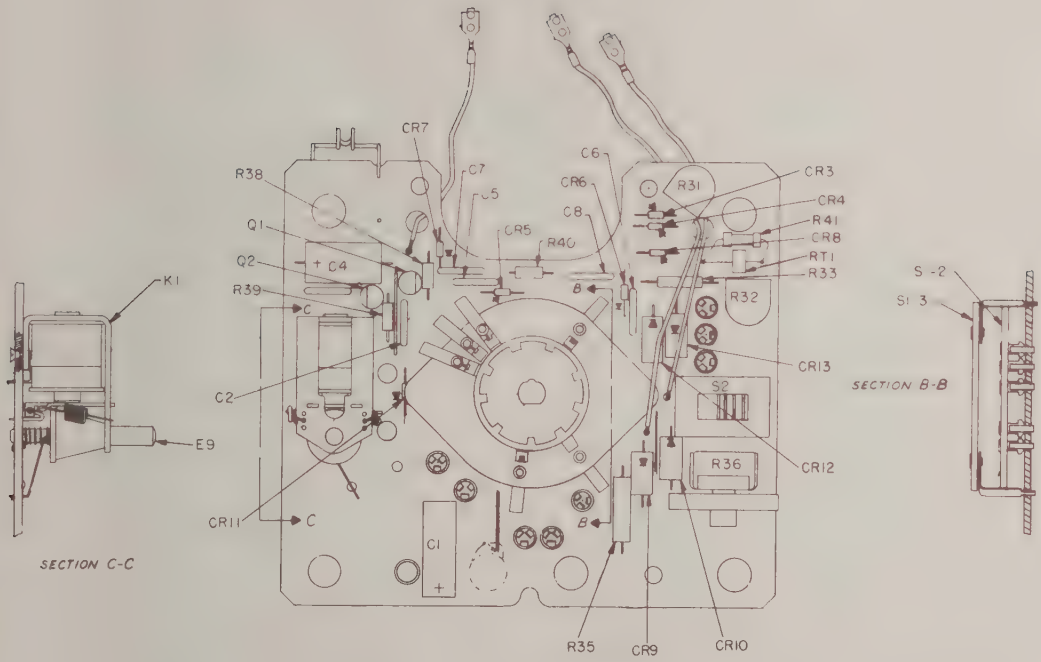

FIGURE 8. INNER BOARD ASSEMBLY

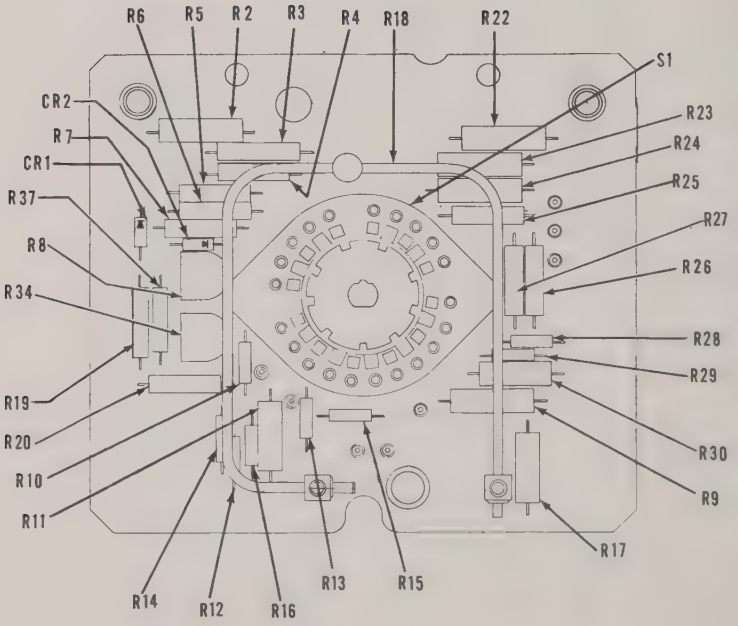

FIGURE 9. OUTER BOARD ASSEMBLY

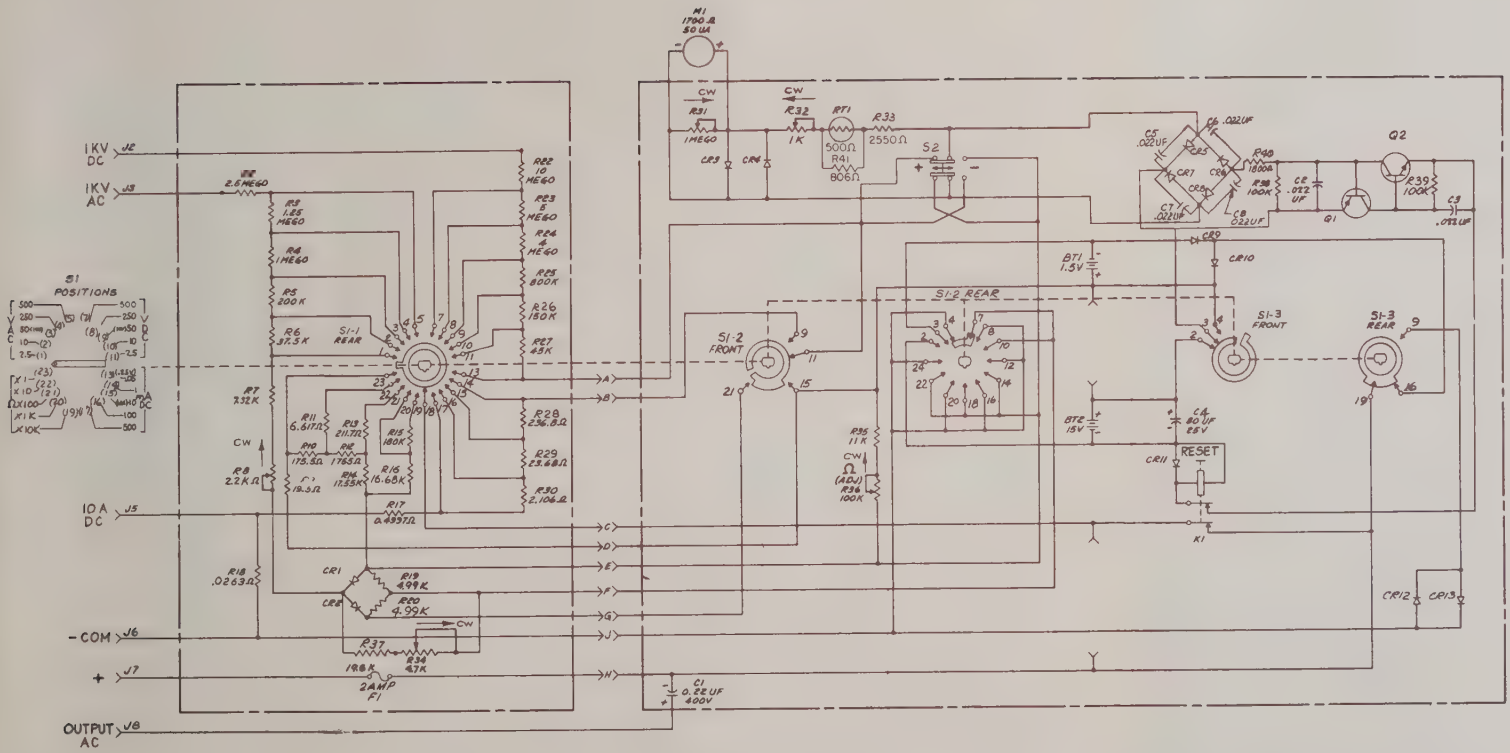

FIGURE 10. SCHEMATIC DIAGRAM

WESTON EQUIPMENT WARRANTY

Weston warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment. The Weston Model 663 series is also warranted to operate with no greater than ±5% degradation in accuracy after a 5 foot drop onto a horizontal floor. This warranty does not include mechanical parts being defaced (scratched, etc.) from a drop or normal usage.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Weston equipment, at an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that (a) Seller is promptly notified in writing by Buyer upon discovery of defects, (b) Upon receipt of written authorization from Seller the defective equipment is returned as directed, transportation charges prepaid by Buyer, and (c) Seller's examination of such equipment discloses to his satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose to the original purchaser or to any other person. Seller shall not be liable for consequential damages of any kind.

The aforementioned provisions do not extend the original warranty period of any article which has been either repaired or replaced by Seller.